GAS JOURNAL

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CONDENSER DESIGN

THE question, how far the gas engineer should go in specifying the detail of plant to be manufactured to meet his requirements is always one of great interest and importance. If he merely specifies the duty to be performed he is likely to have difficulty in making a selection between too great a number of proposals. If he specifies in too great detail the elements of the design he prefers, based perhaps upon what he has used before, he is likely to miss the possibility of getting the advantage of improved design which the generally wider experience of the specialist constructional engineer may enable him to put forward.

In a recent specification of condensers, for instance, it was laid down that (and it is necessary, in view of the arguments put forward in the excellent paper by Messrs. Francombe and Grant, of the firm of Whessoe, Ltd., on the selection and design of gas condensing plant, to give the precise figures) for a duty of 10 mill. cu.ft. per day of gas of specified origin, calorific value and temperature, three condensers were to be provided each capable of dealing with 5 mill. cu.ft. per day so that two could take the full load with the third as a complete standby. It is possible that the constructional engineer, if left to use to the full the results of his experience, would have suggested other units both in number and capacity which would have given better service, possibly at less initial cost, avoiding the potential losses due to capital locked up in the standby unit and its deterioration while standing which might be as much as when in use.

The point is that, consistent with getting plant fully capable of the duty, the constructional engineer should always be given the freest possible hand in the formulation of his proposals. The risk is perhaps not so very great, for such is the good understanding between the two sides of the industry that no constructional firm of repute would hesitate to put forward alternative suggestions, and no wise gas engineer would fail to give those suggestions his full, careful and sympathetic consideration. Indeed, development in gasworks design and practice has frequently arisen in this very way.

Messrs. Francombe and Grant have admirably set out in their paper, which was published in the *Journal* last week, the principles which should guide the gas engineer in the specification and selection of gas condensing plant, the economic and technical criteria by which designs should be assessed. In the selection of this class of plant, as in that of most other types, the initial capital cost is by no means the sole criterion. In this case, annual water charges may be very high in proportion to capital charges. It is shown that in a given instance, of a 4 mill. condenser, capital charges on a 20-year life may be £360 per annum, while water cost at 3d. per 1,000 gal. might be, at the designed duty, as much as £1,150 per annum. The cost of water should therefore have a very material bearing on the design and arrangement of condensing plant. As a broad generalisation, the capital cost of a condenser is relatively unimportant unless correlated with the annual water charges. Another significant point is that while high gas velocities result in a saving of heating surface and reduced capital cost, this saving may be swallowed up in increased exhauster running cost. At the same time, somewhere, there is an optimum in permissible pressure loss, and the authors come to the interesting conclusion that this may be somewhere between 2 and 6 inches water gauge rather than at the usual 1 to 2 inches.

Apart from this combination of capital and maintenance charges with annual running cost, the economic factors, attention is drawn to the technical factors, such as ease of maintenance and replacement, maintenance of efficiency over long periods, all dependent on the type of gas to be treated and the characteristics of the available water. The reasons for the prevalence of the modern high velocity vertical tube design are fully set out, together with those for the preference of welded mild steel as the material used in its construction.

The contribution by Messrs. Francombe and Grant is a model technical paper, setting out with a welcome economy of words the salient features in well-balanced proportion of just what the authors wished to convey with no more detail than just what was necessary to support and illustrate their argument.

INDUSTRIAL DISTRICT HEATING

DURING the past few weeks the Institute of Fuel has been directing its attention, at conferences in London and Manchester on combined heat and power supplies, to the possibilities of coal-saving by the co-ordination in suitable districts of the demand and supply of heat and power among a diversity of industrial plants. It will be remembered that Mr. G. M. Rimmer presented to the Institution of Gas Engineers in 1947 a scheme which we take it is now in operation in Birmingham by which electricity is generated at a constant rate by waste heat and unsaleable fuel at the gasworks and the surplus, as it arises, is fed into the grid, while when the internal demand exceeds the supply the balance is imported from the grid. We remarked then that such a scheme is only applicable to the fairly large undertakings. The interest of the present discussion is that it suggests the possibility that undertakings of less capacity might play a part in district heating schemes.

The Institute of Fuel has been discussing the possibilities in (a) combining two or more works of diverse character to secure an internal balance of heat and power, or (b), with more ambition, a whole district with a fair number of different factories and processes, or (c), with still more ambition, the linking up of the whole industrial organisation of the country with the national electricity grid. It is interesting to note here that our mechanical and electrical engineering friends are not so certain as they used to be of the economic success of district heating as applied to domestic requirements. They think, however, that this

industrial district heating, with or without the inclusion of domestic district heating, might in some suitable cases be a success. Some of the chartered fuel technologists go so far as to say that it is an economic necessity, and there is much force in their arguments. For we must somehow save coal.

The problem is this. Steam (heat) and power are generated in combination—how is a reasonable balance to be obtained? 'It is known,' said Mr. H. E. Partridge, 'that the thermal efficiency of electrical generation at full steam condensing stations can never be more than 30%. On the other hand, in industrial plants where combined heat and power supplies are provided, the thermal efficiency can be as high as 70%. The gap between these figures must somehow be bridged. . . . By interlinking industrial plants with each other and with the grid it is possible to improve the balance between heat and power and thus secure the maximum efficiency.'

Dr. G. E. Foxwell discusses the limited scheme, where a limited number of adjoining works are to interchange their surpluses of power, steam or fuel gas. For instance, coke ovens dispose with advantage of their surplus gas to neighbouring gas supply districts, in the best cases disposing of the whole of their coal gas using unsaleable or poor quality coke for their own heat requirements. There are ironworks with a surplus of blast furnace gas after all the internal needs of the works have been met. This gas has been regarded as a waste product; actually it is an expensive commodity representing half the heat value of the very costly furnace coke used in the iron-making process. These are examples of economy secured by putting fuels to uses commensurate with their real value. But the more general case is that where power generating plant is put down to cover peak loads, or where steam is raised in large quantity for process purposes, and where there exists a want of balance within the individual works between steam requirements and those of power. Obviously if these surpluses are different in two or more adjoining works they can be pooled so that a balance, or a nearer approach to a balance, can be achieved. There are difficulties even in this limited scheme, some legal but mostly psychological. And the inter-linkage involves the solution of some business problems. Who is to pay for the connections? What prices are to be paid for surplus steam, gas, or power? And so on; but all capable of solution given goodwill and business acumen.

But the main attention of the conferences was directed to the interchange of heat and power spread over the whole of an industrial district. Mr. Partridge set out a table of industries, 14 in number, when the diversity in the proportion of heat to power is expressed in the form of the ratio of steam in pounds per hour per kilowatt of power. An engineering works requires power but practically no steam. A rubber plant may require 12 lb. of steam per hour per kilowatt. A laundry would show a steam-power ratio of 100, a brewery as much as 833. The average of the 14 cases was 24 lb. of steam per hour per kilowatt of power, for which in Mr. Partridge's view, a combined steam and power plant could be readily designed.

It is realised, of course, that no existing district might present precisely the picture suggested in this collection of industries. The suggestion is that the conditions prevailing in one or more collection of industrial plant each within a relatively small geographical area should now be carefully surveyed. Among the more important necessary data would be the electrical, process steam, and hot water loads in each plant with daily load charts. If the load curves showed that the maximum demand for individual works occurred at the same periods each day (or week) throughout the year, no dovetailing arrangements would be possible, and the case for co-ordination would fall to the ground. Obviously a diversity of industries within the area would be the most likely to present characteristics favourable to balancing by co-ordination. Even so it is most likely that it would be necessary to incorporate with any such district scheme two-way power traffic with the existing grid.

WORKS VISIT UNDER NATIONALISATION

On May 11 the Southern District (Sussex Area) Circle visited the works of R. & A. Main, Ltd., thus following for the first time a path known and valued by most Salesmen's Circles. Not only was this the firm's first opportunity to act as host since nationalisation, but as far as we are aware, this was the first Circle to take part in any works visit since that date. And it was also the first visit to a manufacturers' undertaken by this 'baby' of the Circles, which has convincingly cut its teeth since its inaugural meeting in October last. This visit, like so many others before it, provided convincing proof of the value of showing salesmen the construction of the appliances they sell. It would indeed be unfortunate if changing conditions affected adversely either the hospitality offered by the manufacturers or the salesmen's freedom to accept it.

EDUCATIONAL ACHIEVEMENT

From the British Gas Council (which nominally faded on May 1) we have received two companion volumes which will prove of great practical value. We regard these two books, both of which are admirably presented in format, style, and print, not only as a background service for the gas industry but as a pioneer effort, directed through specific channels—the architect and the builder—to the ultimate advantage of the gas consumer, which term now implies the general community. One of the books, 'Domestic Gas Handbook for Architects and Builders,' is priced at 20s.; the other, 'B.S. Codes of Practice for Gas Installations,' costs 15s. The two together—and we think they should be considered as inseparable twins—are to be had for 32s.

These books are the result of committee work. They are authentic, and the authorship (in the case of the first-named book consisting of over 20) results in a valuable set of data and well-informed text. As a consequence of committee work there is

JOURNAL CENTENARY VOLUME . . .

NUMEROUS enquiries having been received for binding copies in permanent form, we are pleased to announce that this service is available for any of our readers. Cream art canvas on a stiff board, with gold titling on the spine and face, has been decided upon, and the cost will be 10/- per copy.

Will those who wish to take advantage of this service, please return their copies of the Centenary Number to the publishers, Walter King, Ltd., 11, Bolt Court, Fleet Street, London, E.C.4 as soon as possible.

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nothing whatever of originality or drive in these publications. They present facts, wisely chosen over several years, helpful to the architect in particular, helpful also to the individual manager of any gas undertaking from Land's End (South Western Gas Board) to John o'Groats (Scottish Gas Board). There is no 'propaganda' in the modern sense of this word in these books, but we think that because of this they will the more readily influence intelligent opinion.

COAL OUTPUT DECLINES

Statistics from the Ministry of Fuel and Power show that the output of coal for the week ended May 7 declined by 275,400 tons, compared with the previous week, to 4,087,200 tons. This was also 33,800 tons less than the corresponding week last year. Tonnage estimated as lost through holidays was 187,000 tons, compared with 180,200 tons last year, and disputes caused a loss of 88,300 tons, against 13,200 tons a year ago. Thus the strikes in the Lancashire coalfield have already begun to make their mark. Of the week's total, 3,797,000 tons came from the mines and 289,500 tons, the highest weekly figure this year, from opencast operations. Aggregate output of coal for the first 18 weeks of the year was 75,331,900 tons, which represents an increase of just under two million tons compared with the corresponding period last year. In the week ended April 30, output per manshift overall rose from 1.08 tons to 1.15 tons, and output per manshift at the face from 2.88 tons to 2.98 tons. Absenteeism at the same time declined from 13.22% to 11.39% for all workers in the industry. The statistics also show that for the week ended May 6, the first week of the gas industry under nationalisation, the total amount of gas made at gasworks was 8,583.6 mill. cu.ft.

STATE CONTROL OF STEEL

Sir Frederick Bain, retiring from the Presidency of the Federation of British Industries after holding office for two years, threw out a challenge to nationalisation advocates to bring forward any instance in which privately-owned industry had attempted to thwart post-war achievement of national objectives or disregard national responsibilities when he addressed the annual meeting of the Federation last week. His earlier misgivings about nationalisation policy had, he said, been intensified by recent Government action on the iron and steel industry and by the plans to be discussed shortly by the Labour Party conference. The Federation is not a political body; it stands to represent the views of industry to whatever Government may be in power and to do what it can to safeguard the interests of industry and of the nation from the effects of ill-considered policies and harmful measures. 'The nationalisation of a great basic industry such as steel, vigorous in its plans for development, efficient in its conduct, alive to the need for scientific research, and enjoying harmonious relations between its management and workers, is something far transcending party politics, and affects the well-being of our whole economic life,' he declared. 'Other important industries appear to be similarly threatened. In such circumstances we should be betraying our trust if we failed repeatedly and emphatically to raise our voice in protest! It was vital to Britain today to exercise ingenuity, react flexibly to quickly changing circumstances and to show energy and speed in judgment and action. Those were the qualities of private enterprise, not of vast, slow-moving state organisations. As he saw it, their problem was becoming more than ever a problem of selling in a world which itself grew yearly more capable of supplying its own wants, and which was rapidly overtaking arrears created by the war. Could anyone without prejudice doubt which form of organisation—privately-owned industry in its thousand forms, or the giant public corporation which could not conceal itself behind an array of seemingly separate entities—would be the quicker to adopt novel sales expedients, to make those quick decisions by which the winning of orders so often stood or fell?

A VITAL QUESTION

Turning to the question of costs, Sir Frederick commented that it was clear the days were fast approaching when we should have to revise our thinking. For 10 years we had lived under conditions in which costs had been secondary to production. Now the time was near when we must once again fight for our lives in a competitive world. The gravest internal danger that confronted us was inflation. It was because they recognise this that the Federation had supported the Government's policy of restraint, as laid down in the White Paper on Personal Incomes, Costs, and Prices. A notable response was given to the appeal to industry last year to restrict voluntarily the distribution of dividends, and he felt sure that the great majority would continue again this year to show moderation in this respect. Machinery replacement and the cost of financing stocks had greatly increased. If costs were to come down, every help and encouragement should be given to industry to install the most up-to-date plant and machinery, and to maintain its working capital.

Personal

Mr. ROBERT MEIKLE, foreman with the Girvan Gas Company for 11 years, has been appointed Manager at Muirkirk.

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Mr. ARTHUR SIMPSON, head of the rental department at Newcastle, has retired after 50 years in the gas industry. He has received presentations from the staff and the British Gas Staff Association.

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Mr. C. E. KNIGHT has resigned his appointment as Assistant Director to the Combustion Engineering Association and also as Secretary of the Underfeed Stoker Makers' Association. Mr. ARTHUR COE, Director of the Combustion Engineering Association, has been appointed Secretary of the Underfeed Stoker Makers' Association.

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A presentation has been made by the gas staff at Durham to Mr. ALAN S. MIDDLETON, Secretary of the former Durham City Gas Company, who is now an Assistant Secretary at the Newcastle headquarters of the Northern Gas Board. Mr. Middleton is also Hon. Secretary of the North of England Gas Managers' Association. His successor as Secretary at Durham is Mr. J. C. MORLEY, formerly Sales Manager.

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At a recent meeting of Dewsbury Town Council, the Mayor (Mr. Walter West), in paying tribute to Mr. H. L. BATEMAN, Engineer and Manager, said how valuable his services had been. The Chairman of the Gas Committee, Mr. Percy G. Lyles, also paid tribute to the work of Mr. Bateman, and in wishing him success under the new régime, said he hoped the nationalised gas industry would be as courteous as the Committee had been in dealing with the general public.

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At a farewell dinner given by the Stafford Gas Committee to about 100 employees of the gasworks, to mark the change over, a presentation was made to Alderman G. OWEN, in appreciation of his services as Chairman. Alderman Owen presided, and was supported by Mr. T. H. Poulson, Engineer and Manager, Mr. W. Cox, Works Superintendent, and other officials. The presentation, which consisted of a silver tea set, was made to Alderman Owen by Mr. F. Hill, Showroom Manager.

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The Council of the Gas Research Board has agreed, at the request of the Council of the Institution of Gas Engineers, to release Dr. W. T. K. BRAUNHOLTZ from his duties as Secretary of the Board, so that he may devote his undivided time to the increasing work of the Institution. Dr. Braunholtz, who took an active part in drawing up the Memorandum and Articles of the Gas Research Board, in establishing the Board as a legal entity, and in its incorporation in 1941, has been Secretary since its formation in 1939 and was also Acting Director during the first three years of its existence. The Council has appointed Mr. A. J. PENSTON, M.A., to be Secretary of the Gas Research Board as from May 1. Mr. Penston was educated at the Bolton School, where he was Lever Scholar, and Brasenose College, Oxford, where he was Junior Hulme History Scholar. He obtained Honours in Economics and in Law, to qualify for his M.A. degree. After three years with the Orient Steam Navigation Company, as Purser, he became Accountant and Assistant Clerk to the Governors of the Cripplegate Foundations, in the City of London, a position to which he returned after demobilisation. His war service included four years with the Navy, Army, and Air Force Institutes, as Office Manager and Branch Accountant in the West of England, followed by three years as Accountant Officer, RASC/EFI, in North Africa and Italy. He joined the Gas Research Board as Assistant Secretary in February, 1948.

Mr. A. J. Penston, M.A

Commander COLIN BUIST has been appointed Chairman and Managing Director of Coalite and Chemical Products, Ltd. (formerly Low Temperature Carbonisation), in succession to the late Col. W. A. Bristow. He also becomes Chairman of the three subsidiary companies—the British Diesel Oil and Petrol Co., Doncaster Coalite Co., and the Derbyshire Coalite Co.

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Mr. RICHARD TURNER, who retired from the post of General Manager and Secretary of the Bedford Group of Gas Companies at the end of March, was presented on April 30 with a 16th Century oil painting by the employees as a token of the high esteem in which he is held. Having reached retiring age in November, 1941, Mr. Turner agreed to continue in the service of the Company to carry it through the difficult war years. Born and educated at Bedford, Mr. Turner left school early in life and after five years' general training in valuation and accounting with a Bedford firm, he joined the Gas Company and took charge of the accounts. He became Secretary of the Company in 1938, and a year later on the retirement of the late Mr. J. B. Hansford, was appointed General Manager. He is an energetic member of many public bodies including the Town and County Councils and holds several important offices, and is Chairman of the County Beekeepers' Association.

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On the eve of leaving the York, Harrogate, and District Group of Gas Companies to take up their appointments with the North Eastern Gas Board, Mr. A. MCDONALD, General Manager, and Mr. F. W. ALLUM, Assistant General Manager, were the guests of honour at a farewell dinner given by the Directors and Staff of the Group at Harrogate. Presentations, in the form of a silver tea service and a bound volume of signatures, were made to Mr. McDonald, while Mr. Allum received a wrist watch. In proposing a toast to Mr. McDonald, Mr. G. P. Jennings said although they were sorry to lose him as General Manager, they rejoiced in his well-deserved advancement in the industry. Responding, Mr. McDonald asked the staff to give to his successor, Mr. N. C. Sturrock, the same loyal friendship and co-operation which they had given to him. Mr. H. H. Birkinshaw proposed the toast to Mr. Allum, who in reply expressed his thanks to the Directors in the Group, naming Mr. Seaton, Mr. Potter Kirby and Mr. Bloor. Mr. F. H. Nicholls proposed the toast of the gas industry and Dr. Roger S. Edwards, Chairman, North Eastern Gas Board, responded. Mr. N. C. Sturrock also spoke, and Mr. J. E. Holliday was Chairman.

Appointments

North Eastern Gas Board

Additional appointments are announced by the North Eastern Gas Board as follows: *Administrative Officer* (Industrial Relations, &c.), C. L. DAVIES; *Assistant Solicitor*, S. L. BRUNT, F.C.I.S.

West Midlands Gas Board

In addition to the appointments already announced in the *Journal*, the West Midlands Gas Board has appointed Mr. H. R. HEMS, A.M.INST.GAS E., as Industrial Gas Officer; his office is at Brasshouse Passage, Broad Street, Birmingham (Telephone: Midland 6231). The office of the Distributing Engineer is at Lord Street, Birmingham 7 (Telephone: Aston Cross 3061), and that of the Chief Accountant and the Coal and Transport Officer and his deputy is at Gas Offices, Edmund Street, Birmingham (Telephone: Central 7000).

Southern Gas Board

The Southern Gas Board announce the following appointments, in addition to those already recorded in the *Journal:*

Chief Accountant: J. M. S. RISK, B.COM., C.A., A.C.W.A. (Head of the Department of Industrial Administration, Royal Technical College, Glasgow).

Divisional Accountants: Northern Division: J. H. BLACK, B.A.(OXON), A.C.A., A.C.W.A. (Director of Turner & Cameron Tools, Ltd.). *Central Division:* G. S. DUNSTER, A.C.I.S. (Secretary and Accountant, Reading Gas Company). *Western Division:* W. H. HADDLETON, F.C.I.S. (Secretary, Croydon Gas Company). *Eastern Division:* R. W. HEWITT, F.C.A. (Secretary and Accountant, Portsmouth and Gosport Gas Company).

The Chemical Research Laboratory, D.S.I.R., at Teddington, Middlesex, is again holding a series of 'Open Days' this year. There will be three sessions, on June 30 (afternoon), and on July 1 (morning and afternoon). The Director will be glad to receive, up to June 20, applications from industrial firms wishing to send representatives. It is not necessary for those already on the invitation list to reapply. The five main branches of research are: (a) Corrosion of Metals, (b) Organic Chemistry, (c) Inorganic Chemistry, (d) Radiochemistry, and (e) High Polymers and Plastics.

Diary

May 19-20.—**Eastern Association of Gas Engineers and Managers:** Annual Meeting, Clacton-on-Sea.

May 24.—**Southern Association of Gas Engineers and Managers:** Spring General Meeting, Connaught Rooms, Kingsway, W.C., 2.30 p.m. Paper by H. H. Brown. Council Meeting, 11 a.m.

May 25.—**Manchester District Junior Association of Gas Engineers and Yorkshire Junior Gas Association:** Joint visits to Rochdale Road Works and West's Gas Improvement Co., Ltd. 'A Review of Carbonising,' Mr. Gaskill (West's Gas).

May 26.—**Midland Association of Gas Engineers and Managers:** Summer Meeting. Solihull.

May 28.—**Scottish Junior Gas Association (Eastern District):** Annual General Meeting, Kirkcaldy.

May 31.—**Southern Association of Gas Engineers and Managers (Eastern District):** Visit to Hilsea Gasworks, Portsmouth.

June 2-3.—**Home Service Business Conference:** Gas Industry House.

June 10.—**London and Southern Junior Gas Association:** Annual General Meeting.

June 11.—**London and Southern Junior Gas Association:** Summer Visit to Southampton.

June 18.—**Scottish Junior Gas Association (Eastern District):** Annual Outing.

June 22.—**Manchester District Junior Association of Gas Engineers:** Ladies Day. Visit to works of Southport Gas Department.

June 25.—**Wales Junior Gas Association:** Summer Meeting.

News in Brief

The Registered Office of the Gas Research Board was moved, as from May 1, from Gas Industry House to the Board's new headquarters at The Abbey, Southend Road, Beckenham, Kent. (Telephone: Beckenham 5014-6.)

Prosecuting Solicitor at Market Rasen (Lincs) Police Court on May 9 asked the magistrates to agree to the withdrawal of 27 summonses, most of them dated April 29, against the Market Rasen New Lighting Company, the local gas undertaking, alleging that the Company had supplied coke to other than registered customers. He said the Ministry of Fuel and Power felt it would not be fair to make the new Board responsible for the acts of the Company but he pointed out that any future complaints would be investigated and dealt with in the ordinary way. The magistrates agreed to the withdrawal of the summonses.

Over Seventy Members of the Women's Gas Council visited the works of Wilsons & Mathiesons, Ltd. (Radiation) at Leeds, at the conclusion of their Harrogate Conference. The party, which included Lady Nunburnholme, was officially received and welcomed by Mr. F. Bowen, Managing Director, and Mrs. Bowen and then conducted on a selected tour of the works. The party was entertained to lunch and in the afternoon a visit to Temple-newsam was arranged to view the mansion, birthplace of the present Lord Halifax, which has been acquired by the Leeds Corporation as a place of historic interest, museum, and art gallery. Tea was provided after an hour's tour of the mansion under the direction of official guides.

COAL PRICE CHANGES

In an endeavour to remove some of the more glaring anomalies created by the flat-rate increases imposed during and since the war, the National Coal Board in July, 1948, adjusted the prices of a number of coals. The adjustments did no more than reduce the prices of some of the poorer qualities with compensating increases in the prices of some of the better qualities. The prices of a large number of qualities were unaltered and many anomalies remained.

The adjustments were intended as a first step towards establishing a long-term national price structure for coal in which the quality of the different coals will be as far as possible reflected in their relative prices. Further adjustments will operate from May 30. They are not intended to increase the Board's revenues; as nearly as possible the increases will be balanced by decreases. On this, unlike the previous occasion, the price of house coals will be affected, but there will be decreases as well as increases. The changes, on the average, in the prices of coal for the different categories of consumers are not substantial. There will, however, be large variations, up and down, in the prices of individual coals, increases on the one hand ranging from a few pence to 13s. per ton and decreases ranging from a few pence to over 15s. per ton.

MANCHESTER DISTRICT ASSOCIATION

79th ANNUAL GENERAL MEETING

THE 79th Annual General Meeting of the Manchester District Association of Gas Engineers was held at the Grand Hotel, Manchester, on April 22, and was preceded by a luncheon. Mr. James MacLusky, of Halifax, presided over the proceedings, and there were about 90 members and guests in attendance. Among the guests were Dr. R. S. Edwards, Chairman of the North Eastern Gas Board; Mr. E. W. Tame, Member of the North Western Gas Board; Alderman Houghton Johnson, Chairman of the Blackburn Corporation Gas Committee; and Mr. Geo. E. Currier, Deputy Chairman of the North Eastern Gas Board.

The toast of the Association was proposed by Alderman **Houghton Johnson,** Chairman of the Blackburn Corporation Gas Committee. He mentioned that his own personal association with the gas industry had extended over a period of 20 years. Naturally, they were all considering what might be in store for all such voluntary associations in the future. He did not know whether the remarks of Mr. Herbert Morrison, made some few months previously, about the prospects of the technical side of industry would apply to the industry with which they had all been associated, but probably they did—namely, that all the nationalised organisations could anticipate receiving every possible assistance from the Government which it was able to render. If that was to be the case, then none of them need be apprehensive as to what was to be their fate in the days to come.

Mr. **James MacLusky** (Halifax Gas Undertaking), President, responded to the toast, and expressed appreciation of the remarks made by Alderman Houghton Johnson. He also expressed his pleasure in the fact that it would be his privilege to hand over the Presidential Badge to his successor, Mr. J. D. Ashworth (Blackburn), for the the ensuing 12 months. They were all proud of the results which had been achieved by the Manchester District Association of Gas Engineers in the past. The Yorkshire members were especially pleased that their Lancashire and Cheshire colleagues had elected Yorkshiremen to the Presidential Chair, thus enabling them to gain experience in the fulfilment of an office which allowed them to form many happy contacts with their professional brothers and contacts which had proved to be so much value to them personally. The Association was the oldest English organisation of its kind. It covered the area of two Gas Boards, and he suggested that this fact was of great advantage to the industry inasmuch as they would be able to meet their colleagues serving under the other Board, and to discuss, professionally, matters of importance to the industry. A proposal had been put forward which had been considered by the Council of the Association that the District Associations should strengthen their link with the Chartered Institution and become its District Sections instead of remaining affiliated but autonomous District Associations. There was a strong division of opinion on the subject. The matter had been discussed also by the Council of the Institution, of which he was a district member representing the Association. The Institution, of course, could not issue any instructions. Personally, he thought, and he had the support of Mr. G. E. Currier, who was a member of the Council, and also of Mr. T. R. Cook, that there would be considerable value in the Association becoming a section of the Institution. The Institution could not devote as much time as was necessary to the full discussion of important and sometimes provocative papers. Such papers could be discussed at District Section meetings all over the United Kingdom, and so assist in the ventilation of individual opinions and the advancement of professional knowledge. The problem of extraordinary or affiliated members did not arise in the case of the Manchester District Association, since almost without exception all the members were corporate members of the Institution. The Southern Association of Gas Engineers and Managers had already arrived at a decision to become a section of the Institution.

Area Boards and the Gas Engineer

Mr. **F. G. Shaw** (Buxton), in proposing the toast of the 'Area Boards,' wished to couple with it the names of Dr. Roger S. Edwards, Chairman of the North Eastern Gas Board, and Mr. E. W. Tame, member of the North Western Gas Board. In the gas industry the area boards had secured a wonderful bargain. Perhaps the terms on which those undertakings had been acquired had not given satisfaction to anybody excepting the Government. Nevertheless, the area Boards had now a wonderful opportunity of making the great manufacture of coal gas increasingly serviceable to the domestic and industrial life of the nation. If local initiative was maintained to its full extent, if the necessary materials and plant were provided, so that gas could be supplied in the way that gas engineers wanted it to be, then the industry would be able completely to demonstrate its ability to the nation at large. It was highly desirable that the members of the area Boards should mix freely with gas engineers and see that their energies were not restricted or circumscribed in any way. In the future, the area Boards could rest assured that at all times they would receive the utmost help and careful attention to duty of which gas engineers were capable. That help would be given freely and unstintingly, and he could not foresee that the difficulties of the future were likely to be any greater when the control of industry passed into the hands of the Boards. Perhaps the spirit of economy would not be carried to such extensive limitations as it had been in the past, and it was possible that the gas engineer would be permitted to maintain his plant as he would like it to be maintained. He wished to offer the suggestion that by maintaining the maximum power in local hands, by reinforcing that power by means of the staffs selected, by being enthusiastic in promoting the cause of gas, they would be able to make a really outstanding success in the production of gas.

Dr. **Roger S. Edwards,** Chairman, North Eastern Gas Board, responding to the toast, said there was much wisdom in what Mr. Shaw had stated in his suggestions as to the conduct that area Boards should pursue. His two colleagues of the North Eastern Gas Board who were present with him, along with himself, would take due note of them. He had already quoted once, and he would quote it again, the remark made by Sir John Anderson at the autumn meeting of the Institution. Sir John Anderson was not speaking as a politician, but as a scientist, when he said that the step which was about to take place in the history of the gas industry was in the natural process of evolution. If they approached the months which lay ahead in the spirit that they were all to be live, vital partners in a new and big social economic experiment in which they would have a greater opportunity to develop their scientific skill, then that would be the right atmosphere for the success that the proposer of the toast so earnestly desired. He was convinced that the future of the gas industry for its engineers was a bright one.

Mr. **E. W. Tame,** O.B.E., J.P., also responded to the toast. He sincerely thanked the Association for giving him the opportunity of being associated with their proceedings, and expressed the hope that he would have further opportunities of gaining instruction from its members.

Members rose in silent tribute to the memory of the late Mr. Frank Greenhalgh (Oldham), who died on Dec. 2, 1948, at a time when he was making arrangements for the inspection of the Oldham Gasworks at Higginshaw.

New Members

The following were then formally inducted as new members :—

KENNETH BOLTON, B.SC., ASSOC.M.INST.GAS E., Deputy Engineer and Manager, South Yorkshire and Derbyshire; AUBREY COLE, M.INST.GAS E., Assistant Engineer, York, Harrogate and District Group; GEORGE CROAD, ASSOC.M.INST.GAS E., Engineer and Manager, Sowerby Bridge; THOMAS CROWDY, M.I.MECH.E., M.INST.GAS E., Engineer and Manager, Kendal; PHILIP ROGER DAWSON, A.M.I.MECH.E., ASSOC.M.INST.GAS E., Engineer and Manager, Barrow-in-Furness; WILLIAM THOMAS HIRD, M.INST.GAS E., Distribution Engineer, Wales Gas Board; C. H. RILEY, M.INST.GAS E., Engineer, Manager, and Secretary, Penistone and District.

JOHN C. BARWICK, ASSOC.M.INST.GAS E., General Manager, Clapham Brothers, Ltd., and A. JAMES WINTER, ASSOC.M.INST.GAS E., Superintendent, Meter and Stove Department, Leeds, were inducted as associate members.

On the motion of Mr. **R. L. Greaves** (St. Helens), seconded by Mr. **H. H. Knowles** (Buxton), the Annual Report and Statement of Accounts for the year ended Jan. 31, 1949, were taken as read, approved, and unanimously adopted.

Mr. **C. H. Bamber** (Rochdale) presented the Report of the Lancashire Commercial Section. He proposed that it be accepted.

The motion was seconded by Mr. **H. H. Knowles** and unanimously approved and adopted.

Mr. **H. Singleton** (Huddersfield) presented the Report of the Yorkshire Commercial Section and proposed that it be accepted.

Mr. **N. G. Appleyard** (Leeds) seconded the motion and the Report was unanimously adopted.

The **President** then gave a report of the work of the Institution of Gas Engineers during the period he had been a District Member of Council.

The following recommendations of the Association Committee were then unanimously approved and adopted :—

That the amount of £240 standing in the deferred expenditure account be transferred to the Post Office Savings Bank.

That a donation of 35 guineas be contributed to the Benevolent Fund of the Institution of Gas Engineers.

That Mr. J. D. Ashworth be appointed the Association's District Member on the Council of the Institution of Gas Engineers for the year 1949-50.

That Messrs. H. Platt (Bolton) and N. Hudson (Mirfield), be appointed representatives of the Association on the Councils of the Manchester and District and Yorkshire Junior Gas Associations, respectively.

That Messrs. R. Walker (Manchester), J. H. Clegg (Oswaldtwistle), J. C. Hogg (Stretford), and W. B. Harrison (Middleton), be appointed representatives of the Association on the Lancashire District Gas Education Committee.

That Messrs. J. G. Tilley (East Hull), N. G. Appleyard (Leeds), D. T. Livesey (Doncaster), and J. M. McLusky (Horsforth and Calverley), be appointed representatives of the Association on the Yorkshire District Gas Education Committee.

Mr. **James MacLusky,** the Retiring President, then formally inducted his successor in office to the Presidential Chair, Mr. **John D. Ashworth.**

Mr. **Ashworth** then presented the retiring President with a replica of the badge of office.

Alderman **Houghton Johnson** said that when the proposal to elect Mr. Ashworth to the Presidential Chair was made known to his Committee the news was received with acclamation; and it was remarkable that both the present Presidents of the Manchester District Association of Gas Engineers and of the Manchester District Junior Association of Gas Engineers, Mr. H. N. Dann, were from Blackburn.

Mr. **Ashworth** then gave his Presidential Address. This was published in the *Journal* of April 27.

Mr. **N. G. Appleyard** (Leeds), speaking as the Senior Vice-President of the Association, proposed that a vote of thanks to Mr. Ashworth, and Mr. **Thomas Haworth** (Wigan) seconded, Mr. **Ashworth** responding.

Mr. **James H. Clegg** (Oswaldtwistle) proposed a vote of thanks to Mr. MacLusky, Mr. **R. C. Ruggles** (Radcliffe) seconding.

Mr. **MacLusky,** in responding, said he had been particularly gratified to be able to wear the badge of office, which he had displayed whenever possible on every public occasion with which he had been associated.

Mr. **Charles Cooper** (W. C. Holmes and Co., Ltd.) proposed that the thanks of the members be accorded to the retiring officers for their services during the past year, and referred particularly to Mr. Haworth, who was relinquishing the office of Hon. Secretary. Mr. **W. B. Harrison** (Middleton), in seconding the vote, also spoke in terms of high appreciation of the services rendered by Mr. Haworth during the past six years, which to so many of them had been the most difficult years of their lives.

Mr. **Thomas Haworth,** in responding, said that the past six years of office had been made very happy ones for him by the members of the Association, its Committee, and by six very loyal Presidents. He was sure that his successor, Mr. A. H. Nicholson, of Colne, would have an equally happy experience.

NORTH OF ENGLAND ASSOCIATION

The North of England Gas Managers' Association held their annual general meeting at the County Hotel, Newcastle, on May 6, when some 50 members attended a gathering at which Dr. L. A. Moignard, of the Gas Research Board, gave a paper on 'Sulphur Removal.' Mr. F. L. Scaife, the retiring President, was in the chair. This was the Association's first meeting since the nationalisation of the industry.

At the luncheon prior to the meeting, Mr. J. R. Bradshaw, Deputy Chairman of the Northern Gas Board, offered advice to his colleagues, and Mr. E. Crowther, Chairman of the Board and President of the Institution of Gas Engineers, expressed appreciation of their loyalty under the changed conditions.

Mr. **Bradshaw** said that no doubt they would appreciate that nationalisation brought with it the opportunity to plan for the future of the industry and the vital service it rendered, in a really big and comprehensive way. That did not mean, however, that the Board would unhesitatingly accept proposals for new plant and schemes costing vast sums. It would be unfortunate if it were thought—as he thought that in cases it was—that, because of nationalisation, they could go all out for things they should never have dreamed of under private enterprise. The Board would undoubtedly give sympathetic consideration to large and comprehensive schemes, but of necessity it could not lightly give sanction to such schemes. These would have to stand up to the stern test of practical economics. No doubt there were still a few who felt a sense of grievance and disappointment at the nationalisation of the industry. He did not think it was much use now maintaining that view, and he felt, indeed, that they did not have much really to grumble about. They had all been serving the industry and he thought they had never been very much concerned as to who happened to be the shareholders. They had done their work because they had liked it and for the benefit of the industry and the service it gave as a whole. He wished to congratulate his colleagues on the goodwill and the good feeling they were showing to the new administration.

Mr. **E. Crowther,** Chairman of the Northern Gas Board, expressed his personal appreciation of the loyal manner in which members of the gas industry had met the change in status. He was confident that if the Board could produce the leadership which they desired, then the future of the Northern Gas Board was more than assured. Referring to the Institution of Gas Engineers, Mr. Crowther added that its membership continued to grow. He was happy to believe the Institution had crossed the great divide on May 1 with advancement of its standing and repute in the industry.

Mr. **F. L. Scaife,** President of the Association, welcomed the guests at the meeting. It was decided to make a donation of £21 to the Benevolent Fund of the Institution of Gas Engineers and the Herbert Lees Memorial Prize was presented to Mr. A. D. Mason, formerly of Haltwhistle, Northumberland.

The election of officers resulted as follows: **President,** H. Forrest, Spennymoor; **Vice-President,** F. Wilson, Darlington; **Hon. Secretary and Treasurer,** A. S. Middleton, Durham, who was warmly thanked for his continued invaluable services.

Committee: H. E. Banks, Northallerton; G. E. Anderson, Newcastle, and F. J. Webster, West Hartlepool. J. R. Gledson, Blyth, was re-elected Hon. Auditor.

Elected to the District Education Committee were: F. L. Scaife, Stockton; F. Wilson, Darlington; W. Sutcliffe, Blyth; and J. E. White, Newcastle, in place of the late J. M. A. Mitchell.

Messrs. Duxbury and Scaife were elected to the Hovey Education Trust Advisory Committee and Mr. Wilson was elected district representative on the Council of the Institution of Gas Engineers.

Dr. Moignard's paper will be found on p. 391, et seq.

The 'Gas Journal' Staff Photographer secured these photographs at the annual reception and dance of the London and Southern Junior Gas Association held on April 22. Shown in the two groups, left to right, are: Dr. J. Burns, Chief Engineer of the North Thames Gas Board, Mr. R. S. Johnson, Deputy Chairman of the South Eastern Gas Board, and Mrs. Johnson, Mrs. A. H. Savill, Mr. J. B. McKean, Mrs. McKean, the President (Mr. L. J. Clark), Mrs. Clark, Mr. J. R. W. Alexander, Mr. J. D. C. Woodall, Mr. T. V. Garrud and Mrs. Garrud.

SULPHUR REMOVAL*

By L. A. MOIGNARD, M.A., D.PHIL., A.R.I.C.,
Gas Research Board

THE long history of the removal of hydrogen sulphide from town gas by iron oxide preparations used in conventional box purifiers has not blinded the industry to the shortcomings of the process, and it is not surprising that much attention has been paid to the development of alternatives in most of which the gas is washed with a liquid. In this way it is hoped to eliminate the cost of oxide handling, aggravated as it frequently is by hardening, and, of course, to escape the difficulties caused in oxide box operation by increasing back pressure. The spent oxide problem would disappear, the sulphur being recovered as such, or as sulphuric acid or ammonium sulphate, and there would be a considerable saving in ground space.

There are, however, important reasons why these alternatives have not yet found ready acceptance by the gas industry in this country. The extreme stringency of the statutory requirement regarding freedom of the gas from hydrogen sulphide renders caution advisable, especially when large variations in make have to be considered. Some involve the handling of objectionable liquids (for example, the Thylox process, which uses arsenical solutions) and introduce new and difficult effluent problems. They involve erecting new plant and facing unknown hazards in design and maintenance.

This was our background in undertaking a study of oxide purification. If the perfect alternative process became available to-morrow, oxide boxes would remain in use in the industry for many years to come, so that it is still worth while, even assuming that such a process will be developed to finality, to search for means of mitigating the worst drawbacks of oxide purification and for making continued and improved use of its undoubted advantages. For it has the important merit that it works, reliably, without making undue demands on plant maintenance or technical supervision, and is a process well established and well understood within the industry. Indeed it may be argued that the proper policy is not to be content with a mere mitigation of such troubles as hardening, but to adopt the more positive attitude that the best answer to the problem of purifying an increased make is not necessarily to increase an already high capital charge by putting down more boxes or turning to alternative methods, unless it has first been concluded that the maximum possible duty is being borne by the existing installation. The main hindrances to increasing throughput are loss of activity of the oxide in use and the development of back pressure, accompanied as it commonly is by hardening.

In research on a process in continuous operation in more than a thousand places in the country, it is plainly essential to obtain a clear picture of exactly what is being done, and so an important part of the work consists of visiting undertakings and holding discussions on purification with the officials responsible. Much was heard during the war of 'operational research,' the essential feature of which was studying a problem as it was encountered in the field, and this survey of existing practice was exactly of that nature. It is pleasant to record and express appreciation of the help which has been freely given to us at the undertakings we have visited, and we have been in the fortunate position of being able to compare practice and experience at different undertakings and to pick out features which could never become apparent at one works alone.

Back Pressure and Hardening

The anxiety with which back pressure and hardening have been regarded, especially in the last decade, has naturally resulted in many theories being formulated about their causes. This diversity is related to the wide variations in technique which exist, and indeed it has been most striking to find that, apart from backward rotation, with the admission of air for purification, there is almost no standard practice in oxide box management.

In surveying fewer than 20 undertakings, examples were found of three, four, five, six, and eight box streams, with two, one, or no catch boxes, some of very deep construction, with several oxide layers, others comparatively shallow, with only one layer. One installation of towers was visited. Some sets were buried in the ground up to the lids, others stood at ground level, others were elevated; some were fully exposed to the weather, others fully housed, and examples were noted of many intermediate possibilities. Provision for the control of the direction of gas flow has varied from merely having downward flow to relatively elaborate systems, in deep boxes, of split flow, combined with reversal, so as to expose the various parts of the oxide to the main load at different times. Very diverse types of oxide are used, which can be roughly classified as natural bog ores, activated burnt oxides, and those we have called 'prepared'—*i.e.*, a manufactured oxide in which a proportion of wood chips or sawdust is incorporated. Varied techniques are used in oxide handling and in working part-spent oxide. Rotation periods have been as short as daily and as long as fortnightly; throughputs, in terms of H. B. Avery's R ratio (volume of gas passed per cu.ft. of oxide in one box per hour) have ranged from 10 to 45, and lengths of exposures in boxes from two months to 18. This is by no means an exhaustive list of the variables encountered, and it will thus be appreciated that any hope of finding two works which differed in only one feature, making possible a direct comparison, had soon to be abandoned. Instead, broad conclusions were drawn tentatively from a consideration of the survey as a whole, and then it was possible to compare works with one another in a little more detail. This having been done, much valuable information can be expected to arise from deliberately introducing a change of practice at a works, and this year a number of undertakings are collaborating with us in doing so.

It was soon realised that no single one of the numerous suggestions regarding hardening which had been put forward would account for every case, so that it was natural to suppose that there might be some underlying cause, common to all cases, which had escaped attention. There is now no reason to think that this is so; on the contrary, hardening seems to result from one or more of a number of circumstances, of which the important ones have all been appreciated previously at one time or another. The important consideration is that attention to a number of points in operation is necessary if caking is to be avoided, and it may be that in the past, when one cause has been successfully diagnosed and treated, caking has persisted due to the intervention of another.

Perhaps the best established correlation in the survey was that between severe hardening and the presence of appreciable quantities of tar in the oxide—tar being the material in spent oxide which is soluble in carbon disulphide and is not sulphur. At only one works was severe caking avoided when more than 0.2–0.3% of tar was present in the oxide, and special conditions of throughput, exposures, and air admission obtained here. With conventionally operated boxes, every effort must be made to prevent the accumulation of tar if hardening is to be prevented, and, as will be indicated later, there are other possible incentives for making this effort.

Elimination of Tar

It has to be conceded that the elimination of tar is not particularly simple. In theory, it should only be necessary to maintain the boxes always above the temperature of some selected point in the previous gas stream and to place an electrostatic precipitator at that point to remove tar fog completely. While the desirability of this is widely recognised, shortage of cold water, and overloaded condensers are a serious practical difficulty. For reasons of overall tar extraction efficiency it is customary to place the electrostatic precipitator immediately after the exhauster where some reheating and revaporisation will have taken place, so that while fog removal may be very efficient, some of the offending material may no longer be fog. Secondary cooling between the exhauster and the detarrer would be helpful. Finally, the gas needs to be reheated at the inlet to the purifiers and sometimes individual boxes need heating also. In practice, however, even when these conditions were satisfied and ordinary condensation and deposition of fog must have been prevented, more than 1% of tar could be found in the oxide. In fact, really low tar concentrations were only encountered when the gas had been washed with oil before reaching the purifiers.

There is often a striking contrast between the texture of spent oxide from coke oven installations, at which the gas has been washed for benzole and naphthalene before purification, and that coming from gasworks without the preliminary oil wash. In coke oven gas oxide, the original particle structure, with any woody or peaty filling, where this is used, is still clearly visible, and in the light agglomerate the individual particles are loose. By contrast, it has often been remarked that in a hard cake the structure is much less apparent, as though a cement had glazed over the whole, and the particles are bound to one another. That the solid structure has not been altered can be demonstrated by washing with carbon disulphide when the appearance of the original oxide is restored. This is not due to any intrinsic difference between the gases, since at a works employing coke ovens and

*Paper to the North of England Gas Managers' Association, May 6, 1949, Newcastle-upon-Tyne.

removing benzole after purification hardening of the gasworks type is experienced.

Attention was then directed to the work of the Benzole Technical Committee which investigated sludging in oil washing plants and reported that it was far less serious when benzole recovery followed purifiers than when it preceded it, and it became apparent that whichever of the two plants benzole recovery or purifiers came first in the stream experienced trouble—sludge formation in the one case, hardening in the other. The Benzole Technical Committee concluded that oxidation and polymerisation of unsaturated hydrocarbons which dissolve in the wash oil was responsible for sludging, and it is a reasonable supposition that such substances are absorbed by the oxide and polymerise to compounds of a gummy or pasty consistency. This process is likely to be slow at the temperatures which prevail in boxes, though many materials are present which are known to catalyse polymerisation. There were strong indications that some time was required for this hardening to develop; the severely caked oxides had all been exposed to gas for not less than 10 months at a time, whereas a tarry oxide which had been in the box for only two months was not caked at all.

At one works, employing horizontal retorts, a small naphthalene washer preceded the purifiers, oil being supplied at the low rate of 25 gal./mill. cu.ft. This was sufficient to reduce the tar figure to a low value and severe caking was avoided. This is in agreement with the finding of the Benzole Technical Committee that sludging in the main washer was noticeably reduced if a smaller washer preceded it.

Severe caking, therefore, does not appear to be avoidable under normal conditions if tar is allowed to accumulate and exposures are at all prolonged. The degree of relief from severe hardening which can be obtained by completely preventing condensation of tar within the boxes is under investigation, but there are indications that a preliminary oil wash on or about the scale of a naphthalene wash would be beneficial and may be essential.

Density of the Oxide

Freedom from tar is, however, not of itself sufficient to avoid hardening; we have examined a very hard oxide containing less than 0.1% of tar. The second important factor to be controlled is the density and physical condition of the oxide. Bearing in mind that in working oxide to saleable the dry weight of the material is roughly doubled, perhaps the remarkable thing is that a serious degree of caking can be avoided while securing a high sulphur pick-up per exposure. In order to do so, it is necessary to make provision, by using fillers and exercising proper control over the moisture content, to obtain a light, porous oxide, and to charge boxes in such a manner as to conserve these properties.

Controlling the density of the charge depends in the first place on choosing a suitable oxide. That oxides vary widely in density is, of course, well known, and among the samples we have examined, bulk densities have varied from 68 to 34 lb./cu.ft., as charged. The effective density and porosity can, however, best be compared on the dry basis, since, when oxide is charged to boxes and set to work, a large proportion of the moisture is soon evaporated, leaving the oxide occupying the volume it had when charged. We have examined two natural bog ores, one of which had twice the dry bulk density of the other; two activated burnt oxides which were similarly related; and two prepared oxides which had densities of 34 and 21 lb./cu.ft. The undesirability of high density is recognised to the extent that the heavy materials are seldom charged without blending or lightening.

Variations in bulk density between oxides are governed partly by the filler, but much more by the proportion of free space in the oxide packing. A distinction can be drawn between free space proper such as can be seen in a handful of oxide, and pores in the individual pieces. The pore properties of different oxides have been studied with an apparatus large enough to accommodate about 4 lb. of oxide—*i.e.*, sufficient to allow for lack of uniformity in the material. The packing was adjusted to correspond to a standardised bulk density measurement and was then dried in situ, so that the true porosity, unaffected by moisture, could be measured. The principal outcome of these tests was that the total space varied between 1 c.c. per gramme of oxide for a dense material to 2.6 c.c. per gramme for a light one, the difference depending much more upon the visible free space than upon true porosity changes. On calculating the space taken up by the deposition of a saleable quantity of sulphur, it is found that almost 70% of the total free space would be required by the dense oxide and only about 25% by the light. Especially when there is no reason why the sulphur should be packed away as a stevedore would pack it, it cannot be imagined that one could fill up 70% of the space available without causing back pressure and stresses and strains which lead to consolidation.

Without overlooking the rôle of moisture in the chemical functioning of oxide, it is well to emphasise, with J. A. Speers, that it has an important physical part to play. The bulk density and free space in oxide are plainly dependent on the size grading, upon which moisture exerts a powerful influence. Table I shows this for a burnt and a prepared oxide—the proportion of fines, and the bulk density, falling with an increase in the moisture content.

TABLE I.

Dry Bulk Density and Size Analysis as Affected by Moisture.

1. Activated Burnt Oxide.		
Moisture, %	9	30
Dry bulk density, lb. per cu.ft. ...	51	43
Fines below 72 B.S. mesh, % ...	32	0.5
2. Prepared Oxide.		
Moisture, %	0	38
Fines below 25 B.S. mesh, % ...	59	1.5

At 38% moisture, 60% of this oxide is graded between ⅛ in. and 14 B.S. mesh.

Moisture as a means of controlling the size grading and, as a result, the dry bulk density has some advantage over solid lightening agents such as wood fibres and sawdust, as these may have binding properties similar to those of straw in bricks. Moreover, it is volatile and can thus make room for deposited material.

There is probably more danger of inadequate moistening when charging a part spent oxide than with a fresh charge. It is quite usual to disintegrate an oxide and recharge it with perhaps 10–15% of moisture. Since disintegration is usually responsible for the production of a considerable quantity of fine dust it is the more important to pay attention to careful re-moistening, especially as a part-spent oxide is a difficult material to wet satisfactorily. It has been proposed to use wetting agents to overcome this difficulty. Table II. illustrates this point; it relates to various part-spent charges derived from a certain works, which were size-analysed at the moisture content at which they were put into the boxes.

Table II

Moisture and Proportion of Fines in Disintegrated Part-Spent Oxides.

Moisture, %	Fines below 36 B.S. mesh, %
9.0	33.1
13.2	17.1
17.4	3.3
22.5	2.1
25.7	1.8

Even if the physical condition of the oxide in the heap is satisfactory there is the danger of losing much of the advantage by paying insufficient attention to charging methods. At the works visited at which caking was slight or absent, and where a high sulphur loading per exposure was obtained, emphasis was laid upon this point, and the oxide was poured into the boxes from barrows and spread by hand. Allowing the oxide to drop from a height into the box does involve some consolidation; the bulk density is some 10% higher when the oxide falls freely through 6 ft. instead of through 2 ft., and, of course, in practice much greater heights than 6 ft. are common. It is not suggested that the benefits of mechanisation should be sacrificed by abandoning the conveyor and chute; but with fully mechanised delivery of oxide to the purifier it is still possible to do a considerable amount of hand spreading—for example, from a platform within the box. As regards employment of labour, a balance has to be struck, and it may be possible, with the expenditure of some little extra time in charging, to obtain an overall saving by securing softer boxes.

The hardest oxides we have so far encountered were obtained from deep multi-layer boxes, of the type which have been installed on sites of restricted area, even though the sulphur loadings were not particularly high. Precautions on charging to avoid consolidation appear to be especially well worth while with deep boxes, especially as much time is consumed in discharging them and the development of pressure in a layer below the top one cannot be easily relieved.

It may be argued that the principal consideration should be so to pack oxide that the maximum amount of sulphur is absorbed per unit volume of the box, and, hence, that an oxide should be densely packed and contain a high proportion of active iron. The frequency of charging boxes can sometimes be kept down in this way, but at the expense of hardening and back pressure, since a dense oxide is easier to consolidate and needs to absorb more sulphur in order to become saleable. Even so, at one works at which a dense and a light oxide were being compared, the performance of the former was so poor that its sulphur loading per unit volume per exposure was the lower, let alone per unit weight.

In so far as hardening is related to sulphur deposition, it is important to spread the loading through the layer of oxide. Poor distribution is familiar and troublesome enough in the hard top layers in the downward flow box, whose condition is sometimes aggravated by deposition of tar, and which need to be dug over to relieve back pressure. Sometimes, too, a part only of a discharge is saleable and the rest has to be worked up in a further exposure.

Where gas flow is, say, downward only, a progressive fall in concentration of sulphur through the layer is only a natural

consequence of the absorption of hydrogen sulphide as the gas passes through, and there are many installations at which provision is made for periodical reversal of gas flow so as to expose the two sides of the layer alternately. At some works the danger of forming crusts at the inaccessible bottom surface, at the grids, which themselves must localise the exposure of oxide to the gas, is countered by spreading a shallow layer of peat or straw over the grids before charging.

To obtain even distribution involves avoiding narrow reaction bands. One can visualise that if the sulphiding and re-oxidising reactions were equally rapid, sulphur deposition would be restricted to a narrow layer at the inlet surface, and the spreading which does occur, as well as the need for more than one box with provision for rotation, depend on the fall in activity which occurs in use.

A distinction can be drawn between the temporary fall experienced when the box is in first taken position, due to the sulphiding reaction being more rapid than revivification, and the more permanent change which results from revivification in the stream failing to restore the activity completely. By appropriate choice of the operating conditions the temporary fall in activity can be employed to improve the distribution of sulphur, evidence of doing so being a substantial slip of hydrogen sulphide from the first box towards the end of the rotation period. This would be materially assisted by minimising the opportunity for revivification in the first taker by admitting the purification air to the second taker, but plainly there is better opportunity for practising this in a stream of, say, six boxes than in one of four, especially when consideration has to be given to the occasions when a box is being changed.

If during any one period in the first taken position even distribution in the box is not attained, the formation of hard crusts can only be avoided in virtue of the permanent loss in activity, which can ensure that the reaction is more and more spread through the box each time it comes into first taker position. These changes, to be effective, will need to reduce the activity of the oxide substantially before hardening has become severe and preferably the sulphur content should have attained a saleable value before this stage is reached.

Laboratory Investigation

In the laboratory an investigation has been begun into the activity of oxide up to high sulphur loadings, special provision being necessary, in these comparatively long tests, for control of the moisture content. This is done by arranging to supply liquid water to the oxide in quantity to counterbalance that evaporated, due allowance being made for the water formed in the reactions. In purifiers, ferric sulphide is initially formed, to be more or less quickly re-oxidised; it is possible to visualise the oxidation of a part of the sulphide occurring immediately so that the reaction is virtually a catalytic oxidation of hydrogen sulphide, the ferric sulphide having only a transitory existence. Therefore a comparison was made experimentally between purifying, on the one hand air, containing 1% of hydrogen suphide, to give a maximum opportunity for immediate re-oxidation, and on the other hand hydrogen, carefully freed from oxygen and again containing 1% of hydrogen sulphide. Fouling was then continued until absorption ceased, when the oxide was carefully regenerated in situ with gas containing a little oxygen.

In purifying air, the activity rapidly declined and was restored only to a small extent when the hydrogen sulphide supply was temporarily cut off. It did, however, recover to some degree on prolonged standing even in nitrogen, and almost completely when, after standing, the sulphur was dissolved away. There are indications here that activity can be lost as a result of the formation of surface films, perhaps of sulphur, which slowly recrystallise, re-exposing the surface and restoring the activity. The formation of such films is more in evidence, as would be expected, when the opportunity for superficial reaction is greatest, and this is in accordance with the work of H. B. Avery, who has published microphotographs showing that in alternate sulphiding and oxidation, with the formation of a definite sulphide, the sulphur is to be found inside the oxide particle, having pushed the surface film of oxide away before it as it accumulated. At 20°C. the permanent activity fell less readily in the alternate sulphiding and oxidising reaction than in the experiment on purifying air.

Similar experiments at 40°C. strongly confirmed the work of R. H. Griffith and A. R. Morcom, who showed that at such a temperature ferric sulphide decomposed, if not already re-oxidised, soon after formation, into lower sulphides from which active oxide was only regenerated very slowly if at all. In our experiments the permanent activity fell very much more rapidly when sulphiding and oxidation were alternated than when they went on simultaneously, there being then opportunity for the ferric sulphide to form and decompose. Further more, when hydrogen sulphide was being removed from air a satisfactory balance was obtained between the sulphur absorbed and the elementary sulphur found in the oxide; in the alternating experiments, 40% of the sulphur appeared as sulphates and sulphides.

Evidence from the survey about the influence of moisture is conflicting. At some works, benefit has been claimed by taking precautions to avoid too dry an oxide at discharge; at other works no correlation had been recognised, and at one there is the strongly held opinion that a dry box is a soft box.

Contrary to general experience, it might be expected that moisture would tend to accumulate in oxide, since the gas often leaves the system cooler than when it enters, and is saturated at both places, and the resulting deposition would be supplemented by the water actually formed in the reactions. This would, of course, be only an overall effect: when a box is in first taker, removing 500 grains/100 cu.ft. of hydrogen sulphide in a 3 ft. layer at an R ratio of 25, the heat of reaction could by evaporation reduce the moisture content of the oxide 5% (dry basis) per day, and correspondingly more in a narrower layer. Restoration of the moisture content in the later positions depends either on condensation in the oxide itself or on absorption of water dripping on to it from the lids. The self-insulating properties of the oxide will limit the dissipation of heat necessary for condensation within it, and oxide in the box in bulk is no doubt as difficult to wet as it is in the discharged condition. Accordingly, as is well known, much of the water is lost from the system as drainage from box bottoms and inter-connecting mains.

Consolidation

There seem to be two principal reasons why drying out might give rise to consolidation; one is the setting of colloidal suspensions and the other is the crystallisation of dissolved salts. Oxides may initially contain small particles down to colloidal dimensions, and the work of H. B. Avery, already mentioned, indicates that in alternate sulphiding and re-oxidation there may be opportunity for the formation of more, since, if oxide is moved outwards from the centre of the particle as sulphur deposits beneath it, there are penetration and disruption of the oxide structure. In our laboratory experiments on activity, caking was more severe when sulphur was introduced by alternate fouling and re-oxidation than when it was by the continuous purification of air.

Up to 10% of water soluble salts have been found in oxide, and plainly crystallisation is bound to assist in consolidation; whether it occurs depends on the nature of the salts actually present and on the extent of drying. Salt formation will be related on the one hand to the presence of lime and soda in the original oxide, on the absorption of ammonia from the gas, on sulphide decomposition and oxidation to sulphates, and on thiocyanate and ferrocyanide formation from cyanogen compounds. That these salts are not leached out of the oxide by the drainage from the boxes is additional evidence that the bulk of the condensate does not come into contact with the oxide.

As a result of these investigations, the conclusion was tentatively drawn that hardening could be avoided without unduly frequent discharge of oxide, provided that attention was paid to preventing tar deposition, securing a charge of low density, obtaining as even a distribution of sulphur through the box as possible, and, probably, preventing the oxide drying out. As regards tar, securing the best possible condensation and using electrostatic precipitators at a low temperature are essential, combined with reheating the gas before admission to the purifiers so that they are always everywhere above the electrostatic precipitator temperature. It is still an open question whether under normal operating conditions a preliminary oil wash is necessary to secure a really soft oxide. In so far as polymerisation of tarry vapours is a slow process, there is much to be gained by operating purifiers at as high a throughput as possible, quite apart from the desirability of obtaining the best duty from existing plant. Reheating the gas, so as to avoid condensation, is not without danger, especially under summer conditions, on account of the increased chance of loss of activity through the decomposition of sulphides, and it should be borne in mind that oil washing would eliminate the need to do so.

Proper control of density calls for the selection or preparation of a light and porous oxide, at an adequate moisture content, and charging in such a manner as to conserve this low density. With part-spent charges, especially where a mechanical disintegrator has produced much fine dust, adequate moistening seems especially necessary. One is in agreement with Mr. J. A. Speers, who has pointed out that there is no cure but discharge for the troubles which result from a carelessly charged box. Distribution can be improved by high gas throughputs, by making use of provision for split and reverse flow, and by controlling the air for purification, even to the extent of employing second box air admission. The drying out of oxide can be minimised by supplying the preheated gas saturated, and by employing a short rotation cycle so as to prevent wide fluctuations in temperature. In the survey, short rotation cycles were well correlated with freedom from severe caking, and it may be that this is connected with avoiding deep penetration of sulphide formation into the oxide with the resulting distortion of the structure and establishment of compressive forces between the pieces. Experiments in the laboratory on alternating fouling and revivification suggests that a long cycle is associated with a greater tendency to harden.

Considering the survey as a whole, it seems that the method of purifier operation adopted is largely conditioned by whether the box volume available is large or small. When it is large and R

ratios small, rotation is relatively infrequent and exposures are prolonged. This is possible because at the low rate of gas throughput the decline in activity does not become an embarrassment. Thus, sulphur loadings per exposure are high, a charge sometimes being worked to saleable in one exposure, but this is usually achieved at the expense of hardening. High R ratios call for rapid rotation and shorter exposures, both because of a quicker rate of sulphur loading and because the effect of reduced activity is more serious. In consequence, boxes tend to be softer.

A Wide Programme

This year, we are fortunate enough to have the co-operation of a number of undertakings in carrying out trials on as many of these points as possible ; this help is greatly appreciated, and there are already indications that valuable information will emerge. The tests have been chosen so far as possible with the aim of improving operation and conferring benefit as regards hardening. Thus, where tar deposition is regarded as the major difficulty, attention is being paid to condensation and experiments with oil-washing before the purifiers are being initiated, either in existing or specially fabricated plant. At one works where benefit is thought to result from washing with oil supplied at as low a rate as 25 gal./mill. cu.ft., an experiment to see whether a higher rate further decreases hardening is beginning. At the places where heavy oxide is thought to be the most serious problem, experiments on lightening with various fillers, such as peat, wood chips, shavings, and sawdust are in hand. Special attention is being paid to the moisture content of part-spent disintegrated charges at one undertaking and at works which have successfully overcome the hardening problem the opportunity is being taken to investigate such points as blending, the working of oxide to saleable in one exposure, and the use of alkalis. At Liverpool, a series of experiments on the performance of different oxide has been in progress for some time, and aspects of this work have been discussed in a paper by L. G. Townsend. At Poole, where we are in the happy position of being guests of the Bournemouth undertaking we have been granted special facilities on one of their coal gas purification streams, and are endeavouring to increase the throughput while introducing a number of the modifications in practice which have been mentioned. Such tests necessarily take a long time, and we are eagerly looking forward to assessing the results as they become available one by one. Meanwhile we always welcome information about oxide box management and discussion of experience in purification.

It seems to be widely agreed that hardening has become a more serious problem during and since the war, and while this is a point which is difficult to investigate in the absence of samples, one can see in broad outline some reason why this should be so. The more general use of backward rotation will have resulted in higher sulphur loadings per exposure ; a shortage of labour will have made it necessary to postpone discharges and prolong exposures ; increasing the make in the retort house will have led to less efficient condensation and greater quantities of polymerisable hydrocarbons going forward.

It is frequently suggested that severe hardening is associated with temperatures high enough to cause actual fusion of the sulphur. There are difficulties in the way of accepting this possibility ; so far as we know, such temperatures have not been measured in oxide in normal box operation, and the presence of moisture, which in virtue of its latent heat of evaporation exerts a moderating influence on temperature, makes it difficult to see how they can be attained. Hardening appears to become severe towards the end of an exposure, when the activity has fallen sufficiently to render local high temperature development unlikely, and at one of the works experiencing least difficulty with hardening the preheat temperature, R ratio, and oxygen content were all high. At this works there was almost no tar in the oxide.

Elementary Sulphur

It is unfortunate that nowadays when spent oxide containing, say, 50% of sulphur has been produced, there still remains the serious problem of disposal, and there is no doubt that this has been an important factory in stimulating search for other purification methods which produce elementary sulphur as a final product. The manufacture of sulphuric acid by the contact process is virtually dependent on sulphur imported from America, and there is a growing awareness that this is an economically unsound position so long as elementary sulphur is lying unused in spent oxide. In 1947, 304,000 tons of sulphur were imported at a cost of £2½ million, of which 60% was payable in dollars, while the annual sulphur production in spent oxide must be of the order of 120,000 tons. Its recovery would alleviate the gravity of the situation, which is the more serious because it is always possible that the supply may become less readily available than it has been in the past, quite apart from the currency question.

The present technique of utilising spent oxide by roasting for the production of sulphuric acid cannot be said to have a sound economic future. At present it is adapted only for use with the chamber process, and, as is well known, the burnt oxide residue requires substantial activating treatment before it can be regarded as chemically or physically suitable for further use in purifiers. The question may be asked, why cannot the contact acid manufacturers roast spent oxide? Apart from the very poor activity of the iron residue for further use, the burning equipment and the plant used for cleaning the combustion gases before admission to the catalyst are adapted only for burning the nearly pure sulphur, which the acid manufacturers at present insist on receiving; plant for burning spent oxide is apparently more costly. It is of interest that H. C. Millett recently, in discussing the burning of pyrites for contact acid manufacture, indicated his intention of experimenting with spent oxide.

It seems, however, that the most promising approach is to extract the sulphur with a suitable solvent, and much interest has been aroused in the methods developed in Germany before the war for handling spent oxide, with the dual object of conserving oxide and avoiding importation of sulphur. Carbon disulphide was the solvent; when tar was present in the oxide, and so was extracted with the sulphur, the product was purified while still in solution by destroying the tar with oleum. The extracted oxide was re-used and again extracted two or three times until the prussian blue content had become quite substantial. This was then extracted when the residue was sold to blast furnaces. An essentially similar process is being operated in this country without, so far as is known, the oleum treatment.

It is unfortunate that the only common liquid, carbon disulphide, in which sulphur is freely soluble at ordinary temperatures should also dissolve a large proportion of the tarry substances which commonly accumulate in oxide. As a result the sulphur obtained by distilling off the solvent frequently contains 5% or so of tar and will be little more acceptable to contact acid manufacturers than the sulphur in oxide. All the evidence we have about hardening points to the vital importance of preventing this accumulation, and consideration for the purity of the extracted sulphur should be an added stimulus for doing so. From coke oven gas oxides, when there has been a preliminary oil wash, it is possible to prepare a very satisfactory sample of sulphur by simple carbon disulphide extraction. In the ordinary way it would be necessary to purify the carbon disulphide solution, either by oleum, as in Germany, or by treating the solution with absorbents of the tar—a method which would be economically impossible unless the absorbent could be cleaned and used again.

Carbon disulphide, moreover, is an unattractive solvent on account of its poisonousness and inflammability, and its high vapour pressure would render serious losses difficult to avoid. Thus, it is not surprising that consideration has been given to other liquids in which sulphur is readily soluble at an elevated temperature; from such a solution nearly all the sulphur would crystallise on cooling. It is not feasible to use too heavy a fluid on account of the necessity of recovery from the oxide, and toluene is being investigated as an alternative. At 100°C. the solubility of sulphur in toluene is similar to that in carbon disulphide at room temperature. It has been pointed out to us that toluene or benzole, which are familiar liquids on gasworks, would have the advantage that complete recovery from the oxide would be unnecessary, since, when the oxide was recharged to the boxes, it would be re-evaporated and taken up in the benzole plant. With such a solvent there was clearly the hope that cooling the tarry extract from a gasworks oxide would leave the tar in solution and deposit a satisfactorily pure sulphur. So far as our experience goes this hope is not realised, and a very careful fractional crystallisation would probably be necessary.

Apart from the purity of the sulphur, there are two other aspects of solvent extraction which are the subject of our laboratory work but which can only be mentioned at this stage. It has been indicated that the activity of the residue is likely to have an important bearing upon the economics of an extraction process, and we have found that it is possible to obtain from certain spent oxides at least a very active residue, whether carbon disulphide or toluene be the solvent used, but that from others a much less active material results. The conditions which govern the activity are being examined. Then we have been informed, and have confirmed in a preliminary way, that oxides vary greatly in the ease with which carbon disulphide will extract the sulphur completely, and we are beginning an investigation into this.

Finally, an account of the sulphur question would be incomplete without some reference to the organic sulphur compounds in town gas and methods for their removal. This is a subject with which the Gas Research Board has been actively concerned for some years. Recently J. W. Wood carried out a piece of field survey work in studying the nature and concentration of these compounds as they were affected by the type of coal and carbonising conditions employed. Catalytic oxidation or hydrogenation, together with oil washing to remove the refractory thiophen, has, of course, been worked upon by several organisations, and is being practised by some undertakings. A related topic, the fine purification of water gas from organic sulphur, down to a few thousandths of a grain per 100 cu.ft., was a necessary part of the research work on methane synthesis which the Board have carried out during and since the war.

THE SELECTION AND DESIGN OF GAS CONDENSING PLANT

FOLLOWING is a report of the discussion on the paper on 'The Selection and Design of Gas Condensing Plant' which K. W. Francombe and A. G. Grant, of Whessoe, Ltd., presented at a meeting of the Southern Association of Gas Engineers and Managers (Eastern District) on April 26. The paper was published in the *Journal* of May 4 (pp. 342-349).

The **Chairman** (Mr. W. K. Tate) said there were two points which called for special attention. The first one was the specification which gas engineers gave to a contractor or plant supplier when asking for a piece of plant. In the past, perhaps some of them had not realised how necessary it was to give the supplier a square deal and give him all the details which he must have in order to provide the best and most economical piece of plant. He had been very appreciative of the authors' remarks on that point because it seemed to him that the gas supply industry was moving more and more towards a proper co-ordination with the suppliers of plant. There was the realisation that they were not on two sides of the fence. They were both on the same side of the fence, and the suppliers were as anxious to help the gas engineer and give him what he wanted as the gas engineer was to get what he wanted. He was interested in the set of figures in the paper relating to gas inlet temperature and saturation, dealing with the heat content at various temperatures.

The Cost of Water

It was astonishing how rapidly the heat content grew with relatively minor increases in temperature. The other point which he had found most interesting was the stress which had been laid on the cost of water. At his main works they were, unfortunately, unable to raise a satisfactory quantity of water themselves and it was necessary to buy water. That water at the present time cost about 1s. 1d. per 1,000 gal., and the weekly consumption some time ago was over 3 mill. gal. When putting in a new condenser some 12 or 18 months ago they explored the possibility of fitting a forced draught cooler in connection with it, and he had been surprised at the saving in water that had been brought about by so doing. With this particular condenser they were saving something like £1,700 a year on water, and this condenser dealt with approximately 4 to 5 mill. cu.ft. a day. So impressed were they with this performance that similar coolers were being fitted to all the other condensing plants on both the coal gas and the water gas streams.

Dr. **S. Pexton** (North Thames Gas Board) said the authors had rightly focussed attention on the cost of cooling water and had shown it to be greater in most instances than the capital charges on the condensing plant itself. They emphasised, therefore, that enquiries for condenser plant should include the volume and temperature of the cooling water available. Various systems of dealing with gas of high naphthalene content were referred to in the paper, including that described by Mr. Dougill, Mr. Ravald, and himself. This system provided full cooling of the gas in reversible primary condensers before the exhausters, together with detarring, naphthalene removal, and secondary condensation after the exhausters. The system was working well and produced naphthalene-free gas at a temperature of 63°F., when the atmospheric dry and wet bulb temperatures were 55°F. and 52°F. Because of the complication of reversing valves on the primary condensers this system did not include series flow of the whole of the cooling water through secondary and primary condensers.

Variable Speed Exhausters

The smaller quantity of water from the secondary was, however, passed to the open top of the primary condensers at approximately the middle compartment. The secondary condenser in such a system as described above was necessary to cover inefficiencies during reversal of the primary condensers or while re-tubing part of the primary condensers. For gas from continuous or intermittent vertical retorts which was not saturated with naphthalene even when cooled, no secondary condensation would appear necessary so long as the gas was fully cooled in the primary condensers, and the temperature rise in the exhausters was small. To this end, variable speed exhausters were advantageous. The plant following the exhausters might then include an electro-detarrer, an oil washer for naphthalene and some benzole removal, and an ammonia washer. The sole object of the oil washing stage was to render the gas unsaturated with oil condensates so as to prevent the possibility of their deposition in the oxide of iron purifying mass. For continuous vertical retort and carburetted water gas streams it would also seem profitable to precede the primary condensers with a boiler feed water heater, recovering heat from the crude gas.

The suggestion that condensers might be further reduced in size by designing for even higher gas velocities and providing for additional power for gas exhausting, was worthy of a trial, particularly if applied to continuous vertical retorts where the exhaust steam from the exhausters could be utilised in steaming the retorts. Such a procedure was unlikely to be adopted in cases where naphthalene deposits were liable to form in the condensers.

Mr. **J. E. Davis** (South Eastern Gas Board) remarked that while the Chairman had said it would be wrong for the supplier and the user to consider themselves on two sides of the fence, he was quite sure that they had two different points of view, although not perhaps in the way that might come to mind immediately. The supplier of the plant did know all about the capabilities of his plant, but he did not know much about gasworks and gasworks conditions. Therefore, the suppliers and the purchasers should co-operate in order that the best combination of a well designed plant for the particular works could be provided by the makers.

Overriding Importance of Water

It was during the war years that the authors of the present paper met some of his colleagues in the South Metropolitan Gas Company to discuss in general terms the type of condensing and ammonia recovery plant which might be installed when the war ended and replacement of plant became possible. The discussions turned very much upon heat transfer coefficients, capital costs of plant, maintenance requirements, and similar orthodox considerations. It was only later on, when the new cooling plant became part of a larger scheme, that they realised fully the over-riding importance of water. To-day, he believed that the right line of argument was very much as follows: From the gas-making plant and its ancillaries certain quantities of heat had to be removed and the first task was to make an assessment of these various quantities, classifying them according to their temperature level at the entry and the exit from the heat removing apparatus. Normally, some of the heat could be, and should be used for steam raising, but after that steam had been raised and as much as possible of the heat converted to power, the residue must pass as heat into the cooling water.

As the authors pointed out, there was an upper limit to the temperature of cooling water at its point of reject, a limit which must be observed if corrosion difficulties were to be avoided. If all the cooling water could be raised to this temperature, the minimum quantity to be circulated would have been achieved. But in practice it was hardly ever possible to do that, although the disposition of plant and water connections should be such as to aim for this minimum. There were some interesting combinations which would help towards that end, as, for example, at the Rotherhithe Works, where cooling water from the condensers of the turbo-alternators was employed for the first stage of gas cooling.

In calculating the quantity of water required, the seasonal variations in temperature and gas output had to be taken into account, and it was a wise rule to remember that the most difficult conditions were likely to arise in the autumn when most natural sources of cooling water were at their maximum temperature and gas makes were rising. If, however, cooling water was being re-circulated and re-cooled, the critical time might be in the winter when high gas makes synchronised with mild weather and a high atmospheric humidity.

Two-Stage Cooling

These remarks really only served to underline the matters referred to in the first part of the paper. On the debatable question of single-stage or two-stage cooling, the South Metropolitan Company adopted two-stage cooling in order that turbo-exhausters might assist in the removal of tar fog formed in the primary stage of cooling and that the heat of compression might be removed before ammonia washing. It might be recalled that the sequence was: primary cooler, turbo-exhauster, secondary cooler, electro-detarrer, ammonia washer. It was, however, arguable that a single stage would operate just as satisfactorily if the whole of the work of tar fog removal were thrown on to electrostatic detarrers, a task which they were quite capable of performing. The sequence would then be: cooler, electro-detarrer, ammonia washer, and turbo-exhauster. The heat of compression need not then be removed, as it would be advantageous in raising the temperature of the gas immediately prior to oxide purification. This was a proposal which should receive careful consideration in future plants.

In his experience of two-stage cooling, naphthalene had caused no difficulty. Tar condensed from the gas in the primary coolers was used for flushing the secondary coolers at infrequent intervals, amounting in all to a few hours each week. The flushing when it did take place was heavy, and in nearly a year's work-

ing there had been no indication of any increase in back pressure.

Mr. **G. Dougill** (North Thames Gas Board) sent the following notes which were read by the Secretary:—

There is one point which I would like to stress in connection with this subject. When considering condensing plant the design must be such that it can operate successfully during the hottest periods normally experienced, even though this means that the plant is only partly in action for the remaining six months of the year. This condition is, of course, particularly applicable at Beckton where the carbonising units are of approximately 7 mill. cu.ft./day capacity, each complete with its own condensing and purification plant, and consequently a unit runs at one constant output throughout the year.

Even where the output per unit is reduced during summer, it is still necessary that plant capable of cooling water effectively should be available, and in this connection the use of forced draught coolers has been found invaluable. The benefits of very thorough cooling cannot be over-estimated and there is no doubt that it leads to savings of cost, regularity of operation, and efficiency in all the plant following the condensers. A big step in this direction has been made on the two units at Beckton, and while it is early yet to make a complete statement I am able to say that all the anticipated advantages are likely to be fulfilled.

Recirculation and Cooling

I am pleased that the authors have shown so clearly the cost of water, even when this is recirculated and cooled continuously. In my own mind there is little doubt that recirculation of water which renders only a small 'make-up' necessary is well worth while, as it does make the use of a good quality water practicable.

In conclusion, I should like to ask if the authors have met any failures in vertical tube condensers which have rendered it necessary to replace the tubes and, if so, at what part of the tube it occurred and after what period of operation.

Mr. **C. Cooper** (W. C. Holmes & Co., Ltd.) said that the authors had made a sound and practical approach to their subject, and had mentioned the very important cases where new work had to be supplied to run in conjunction with existing work. It had been suggested by Mr. Grant that for some years past, practice was rather lagging behind theory, and they would probably all agree with that.

Mr. **R. T. de Gruchy** (North Thames Gas Board) also mentioned some practical points in dealing with gas of a high naphthalene content. It had been found at Beckton on the coke oven plant that trouble was experienced if it were attempted to carry out primary cooling. On the newer plant, vertical water tube condensers were used with gas cooled to a low temperature, but not far above the wet bulb, atmospheric temperature. It had been found as a matter of actual experience that the best way was not to try any half-way stage cooling but to get it as cool as possible as far as the condensers themselves were concerned. Reversing the gas flow had been found beneficial. It had also been found that a hot flush was useful when passed through the warmer passes, as long as it was not put through the cold pass, because it would be warming up the gas. In particularly cold weather or if the carbonising conditions were such that the naphthalene content was rather higher than usual, this helped by increasing the flow. Part of the difficulty experienced was that if the flow from the condenser was rather slow, atmospheric cooling in the outlet drain was apt to cool the tarry condensate below its melting point. If trouble with blockages was experienced, the first thing to look at was the carbonising plant itself to make sure that all reasonable steps had been taken to prevent any undue thermal degradation of the gas.

Vertical Tube Condenser

One point in connection with the vertical tube condenser was that at the bottom of the gas space there was a water chamber and there was a tendency there for the condensate to be cooled even before it got out of the condenser. On the newer Beckton plant there was a secondary condenser and it was extremely useful to have that during the summer, but it was possible to get on fairly well without it in the winter. It was worth while to bear in mind the superheat caused by the exhauster. In this particular case the temperature rise was more than usual by over 20° F., and that rise of temperature was associated with extra vapour in the gas. He had noticed that the temperature was very easily lost again as the gas passed through the purifying plant even before it got to the washers.

Finally, he asked the authors for information on the following point. In the vertical tube type of condenser the water velocity was a good deal lower than in the horizontal tube type and it seemed that, under conditions of light load, the flow might reach a critical point and become streamline instead of turbulent. Would the authors expect any noticeable loss in the cooling due to that effect?

Mr. **J. H. Carrington** (South Eastern Gas Board) said that at one time trouble was experienced at Brighton due to the choking of the condensers with naphthalene, but this had been overcome by regular spraying with hot liquor every four hours. Since that practice had been adopted, there had been no trouble whatever with choking.

Mr. **Grant,** replying to the discussion, expressed thanks and said he could not quite accept the remark by Mr. Davis that the contractors could not be expected to know all the conditions on the works. The aim and object of anyone supplying plant to a gasworks was to know all about the conditions on the works. The suggestion of putting in a turbo-exhauster seemed to him a heresy.

In his written remarks, Mr. Dougill made the point that a condensing plant, whatever else it did, must cool the gas properly at the hottest time of the year. That was absolutely true. At any cost the gas must be cooled, and in that connection he drew attention to one of the charts in the paper which showed the flexibility of the condenser. It was one of the most flexible pieces of engineering plant, and if the limits of hottest and coldest could be defined initially then, even with an excess use of water in hot weather for short periods, a condenser which was apparently too small for the particular job would work quite satisfactorily and would not be an uneconomic unit for the rest of the year. This led him to emphasise the need for designing on the basis of overall economics rather than for a particular set of conditions.

With regard to vertical tube condensers, mentioned by Mr. de Gruchy, and the possibility of the water flow becoming streamline instead of turbulent with falling gas throughput, this enabled him to reinforce again the need for the designer to know the complete range of operational conditions. It was true that if the heat transfer equipment fell from turbulent to streamline, they had gone down into a low range of transfer coefficients. The designer ought to know everything in order to design a plant so that the water consumption under all conditions could be controlled.

Continuing, he said he would like to make one final plea, and it was that, when a condensing plant had been built, the owners should keep an eye on it and see whether it was doing what it was supposed to do. He suggested that all gas engineers were guilty in this respect. The gas and water were usually not measured. Usually the pumping system was big enough to put more water through than was anticipated. Then the condenser did not seem to be doing its job, so more water was put through, and consequently the plant did not work as it should do. Therefore, again he urged that the designer should be made aware of all the conditions. Only in this way could the contractor give the best service to the purchaser.

On the motion of Mr. **A. H. Savill** (South Eastern Gas Board), seconded by Mr. **F. White** (South Eastern Gas Board), a vote of thanks was given to the authors.

EDUCATION AT NOTTINGHAM

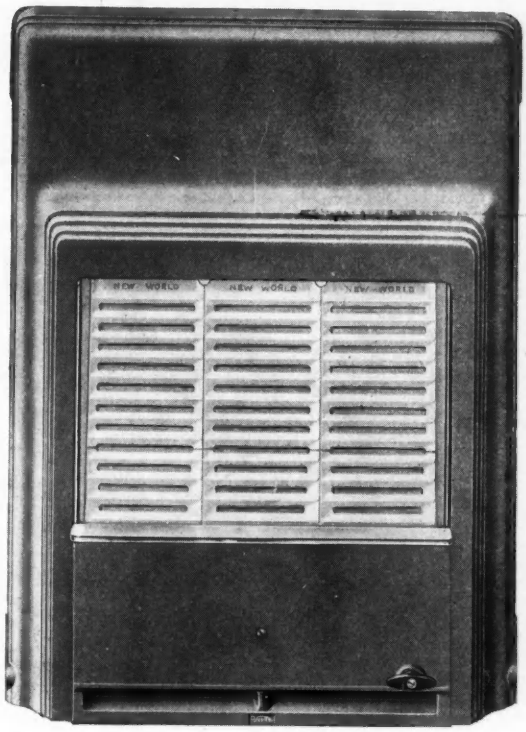
The claim that Nottingham led the Midlands in training successes was made by Mr. P. Bowman, Assistant Fitting Superintendent, after a presentation of City and Guilds certificates to members of the staff of the Nottingham Gas Department. Mr. Bowman said the Department had 90% successes in the final grade and 82% in the intermediate grade, compared with the national percentages of 64.5 and 62.

The certificates were presented by the Sheriff of Nottingham, Alderman W. Sharp, who is chairman of the Nottingham Gas Committee and a worker in the gas industry. He told the gathering that his father, too, was employed in the industry, having worked at the Basford Gasworks, Nottingham. He also disclosed that for the first 12 years of his association with the Gas Committee he had made 100% attendances at all committee and subcommittee meetings.

Mr. R. M. Wilkinson, Engineer and Manager, said they were short of room at their training centre and it was very difficult to get the accommodation they required. Mr. E. Bates, Sales and Service Superintendent, also spoke. Final grade certificates were won by employees who attended the Department's rehabilitation course on return from the Forces and intermediate grade certificates by fitter-apprentices who studied at a training course arranged jointly by the Department and the Nottingham Education Committee.

The Gas Undertaking which Ossett has handed over to the North-Eastern Gas Board was free of debt and had increased its sales during the past year by 15%, according to the report by Mr. G. F. Wilson, Chairman of the Gas Committee, at a meeting of Ossett Town Council. Mr. J. W. Gill said the Department had attained a point at which consumers could have benefited from reduced gas charges through 50 years' efficient administration by the Council. The resources would now be used to assist other undertakings, not so well managed nor as financially sound. Alderman G. Moorhouse saw little hope for the Ossett consumers in view of the increased charges already announced by the Gas Board. The transfer affected Ossett to the extent of a 10d. rate by loss of maintenance charges and services. The Council passed a resolution recording appreciation of the services of Mr. G. Hudson, Engineer and Manager.

The Newstead



No. 7709

Yet another of the attractive range of NEW WORLD Silent Beam Gas Fires now coming into production is the Newstead. Somewhat similar in design to the Tewkesbury, it has, however, a much shallower projection forwards from the surround.

The well-known features—common to all NEW WORLD Silent Beam Gas Fires—are the Rado-Panel front; silence in burning; gas governor to adjust and control pressure with consequent economy in use; three-position tap to facilitate changes of output in regular stages according to needs; automatic lighting attachment to make the use of matches unnecessary; minimum servicing requirements.

The Newstead, too, is available in a choice of attractive colour finishes.

A PRODUCT OF Radiation Ltd

Radiation Ltd *Radiation House, Aston, Birmingham, 6. Showrooms and London Offices: 7 & 8 Stratford Place, W.1 (Phone: Mayfair 6462)*

NEW WORLD NEW WORLD NEW WORLD

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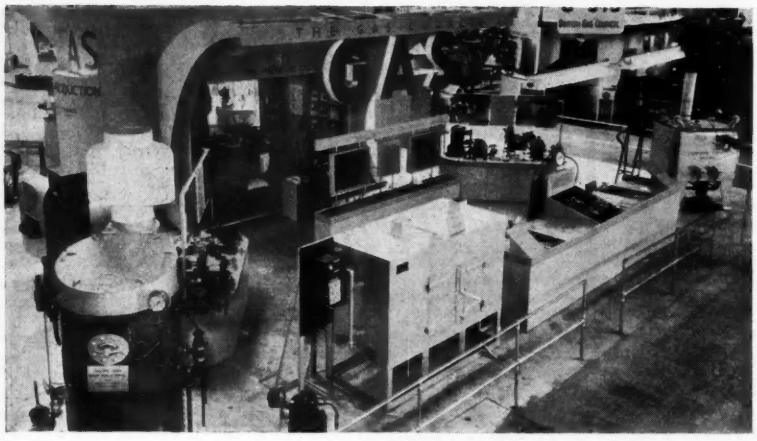

This view of the Gas Council's stand at the British Industries Fair, Castle Bromwich, shows the exhibit of Messrs. J. A. Jobling, Ltd., on which the use of gas in the making of Pyrex Brand glassware was demonstrated, and other exhibits of gas-fired boilers and furnaces.

PUBLICATIONS

The April issue of the *F.P.A. Journal*, the quarterly publication of the F.O.C. Fire Protection Association, 84, Queen Street, E.C.4, includes an interesting article on the research work of the Joint Fire Research Association. Those who are directly concerned in the erection of new premises or extensions to works will find an informative summary of the comparative fire resistance of various types of building boards in current use.

* * *

The Home Service Division, Gas Industry House, has issued a second leaflet in the series, 'Home Service and Gas Sales.' It explains the purposes of demonstrations and divides them into nine divisions, as follows: (1) Regular showroom demonstrations; (2) demonstrations to women's societies and clubs; (3) official contacts; (4) special groups of customers; (5) schools and youth organisations; (6) travelling showroom demonstrations; (7) demonstrations in stores; (8) at exhibitions; and (9) in the window. It presents many useful ideas in a convenient form.

The stand of the Staveley Iron and Chemi cal Co., Ltd., at the British Industries Fair.

Radiation, Ltd., had this comprehensive display at the Birmingham Section of the British Industries Fair.

We have received from the British Thomson-Houston Co., Ltd., a well laid out brochure describing the activities of this firm with some reference to its past achievements. It sets out in considerable detail, both pictorially and in letterpress, its various works and main products, which include heavy electrical machinery, switchgear for power and industrial, motors and generators, Mazda fluorescent, discharge and automobile lamps, mouldings and small electrical accessories.

Newton Chambers' Exhibition

In connection with the inauguration of the new Izal factory of Newton Chambers & Co., Ltd., an opportunity has been taken to provide a display of the Company's products and services, in particular the social amenities provided for and by the employees. The emphasis is mainly on service to the producer. The Company's business is so extensive that a large exhibition would be required for a mere description of its products and processes, and these are only broadly indicated. The skill and craftsmanship on which Newton Chambers draws is so varied that there are over 500 different kinds of jobs at Thorncliffe.

It is as a demonstration of good works relations that the exhibition has special interest and significance. It will be visited by many friends and customers of the Company, but in the main it has been prepared to enable a Thorncliffe community of about 25,000 people who live in the neighbourhood of the works to see what is done by and for Thorncliffe people, and above all, what is done by themselves for the benefit of each other.

In so extensive and many-sided a business, there are departments and activities with which not all the employees are familiar, though it has for some years been fundamental to the Company's training scheme that every boy and girl entering the service of Thorncliffe should be introduced to all the departments, and that the activities and purposes of the Company should be carefully explained and demonstrated. This method has also been followed in 'resettling' the employees returning from the Forces. Nevertheless, a considerable number of employees will have an opportunity of seeing for the first time many things the Company produces.

HISTORICAL RECORDS

A number of gas companies and gas departments have given expression to their desire for a permanent record of the past achievements of their undertakings by publishing brochures to coincide with the nationalisation of the industry.

The Borough of Burnley has published its record of 94 years of municipal service in a commemorative booklet to mark the initiation of extensions to the Oswald Street gasworks. Gas was first manufactured in Burnley to supply a small factory in 1817, and five years later the Burnley Gas Light Company was formed. The history of the municipal undertaking dates from 1855 when the Improvement Commissioners took over from the private company whose output at that time was 26 mill. cu.ft. In comparison, the gas sent out last year was 1,486 mill. cu.ft.

From Manchester we have received *One Hundred and Forty-Three Years of Gas in Manchester*, in which the Gas Committee describes the story of one of the oldest undertakings in the country. The pages reveal that it is almost impossible to say when the undertaking was born, but a few weeks after Trafalgar the Police Commissioners lighted the entrance to their offices by gas, and proceeded gradually to enlarge their operations. The Borough of Manchester took over the gasworks in 1843, and the history of the Department is traced through the years and illustrated by an ample selection of photographs and prints.

The record of the Stretford and District Gas Board covers only the past 27 years from the time of the Board's formation in 1922. There is little information about the earlier Stretford Gas Company, which was formed in 1854. The brochure includes photographs of the works and plant, sections on home service, showrooms, vocational training, and statistics which show the development of the undertaking and a fourfold increase in gas output to the present figure of over 2½ mill. cu.ft. per year. It is anticipated that within the next five years the present works will be too small to meet the growing demand.

Glasgow Corporation has issued a booklet which gives a brief account of the inauguration and development of the city's gas supply. Gas was made for the first time in Glasgow in 1805, when a bookseller named Lumsden, using a small retort heated in his fireplace, lighted his shop with it. In 1817 the Glasgow Light Company was given statutory powers to produce 'inflammable air' from coal, and in the following year the first street lamp was lit. In 1843 a second company, the City & Suburban Gas Company, of Glasgow, was formed, and in 1869 the undertakings of the two companies were taken over by the city under the Glasgow Corporation Gas Act. In 1827, when meters were first introduced, the city's total gas output for the year was some 80 mill. cu.ft. In 1948 more than half that total was produced in a single day.

The history of the Bournemouth Gas and Water Company, 1863 to 1949, sketches the development of a company which has been 'pioneers in every phase of gas engineering, coal handling, carbonisation, purification, distribution, salesmanship, integration, and partnership.' The Company was formed when the town was little more than a village, and the foresightedness of its founders was maintained by such eminent engineers as Colonel H. W. Woodall and Sir Arthur Duckham. Reorganisation of the gas distribution system nearly 40 years ago has enabled the Company to supply the whole area from a central works by means of high pressure and boosting pressure mains through more than 250 district governors. It has also enabled the Company, it is stated, to increase its output during this period from 400 mill. cu.ft. to over 5,000 mill. cu.ft. without any major distribution problems. The booklet is illustrated and includes a short section on the water side of the Company's undertaking.

TRADE NEWS

The Staveley Coal and Iron Co., Ltd., has acquired the whole of the shares in R. D. Nicol & Co., Ltd., manufacturers of oils and greases. Mr. D. M. Anderson will continue to act as Managing Director and Mr. M. Haigh as Director and Secretary.

* * *

Wellington Tube Works, Ltd., have issue a pamphlet describing the 'New Weldex Convector Heater.' The heaters are made with two- and four-tube heating element in three casing styles. The pamphlet gives the heaters' standard capacities for a room temperature of 60°.

* * *

Dewrance & Co., Ltd., announce the opening of an office for the north-eastern area (covering the counties of Northumberland, Durham and Cumberland), at 23, Grey Street, Newcastle-on-Tyne, 1, telephone number Newcastle 21147, under the direction of Mr. W. I. Ferguson. Their Manchester office has also been transferred to larger premises at 10, Corporation Street, Manchester, 4 (Blackfriars 9283).

* * *

During the past two or three years there have been many references to silicone rubber, particularly as regards its ability to retain its elasticity at temperatures both above and below those possible with natural or other types of synthetic rubber, but it is not generally known from what sources processed silicone rubber can be obtained. Richard Klinger, Ltd., have been experimenting in the extruding and moulding of the various grades of silastic rubber marketed in this country in the unprocessed state by Albright & Wilson, Ltd., and Klinger are now in a position to execute orders for this class of work. The grades which they chiefly use are Silastic 160, Silastic 161, and Silastic 181, and they can be supplied in the form of sheets, mouldings, or extrusions.

TRADE CARDS

TOM CARRINGTON & CO. LTD.
Lyndon Toolworks, West Bromwich. T/N 0517 (2 lines).
"LYNDON" and "EGA-KUT"
SCREWING TOOLS:
TAPS; DIES; STOCKS AND DIES
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HILMOR LTD.
Tube Bending Machines (Hand and Power) Tube Bending Specialists.
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We can supply machines for bending Gas and Steam Piping from ⅜ in. to 2 in. in the cold state.

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METAL-TO-METAL JOINTING MATERIAL

Ever since 1913 "PERMAC," the original Metal-to-Metal Jointing, has been holding up difficult joints in Gas Works and on Coke Oven Plants all over the world. Equally suitable for any joint—steam, water, gas, oil, benzol, ammonia, etc.—screw pipe or flange.

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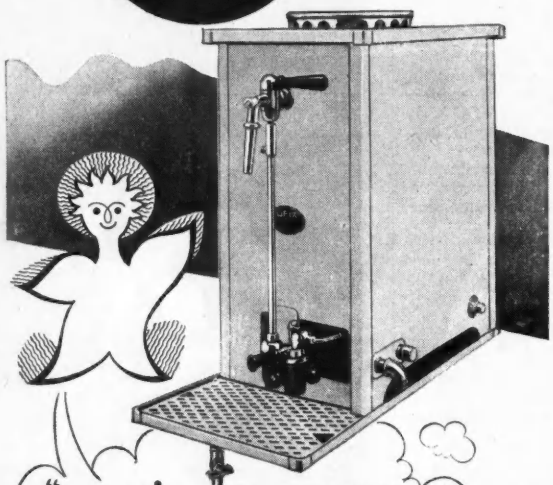


"HERE'S THE WATER BOILER WITH THE *Quick change* INTERIOR"

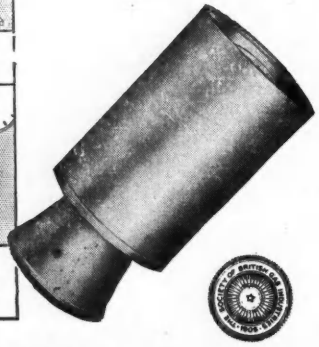
The Gasman arrives with the clean Ufix interior

The scaled interior is removed quickly and simply

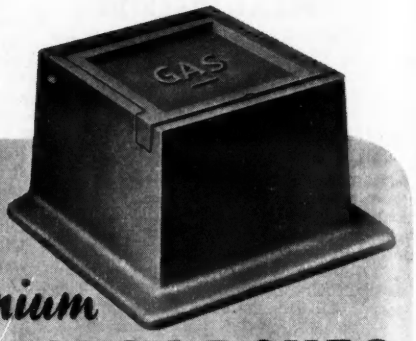
Approx. ½ hour later, job is completed, gas man leaves with scaled interior, this is cleaned ready for next servicing

THE interiors of the Ufix Boilers are interchangeable in a matter of minutes by simply emptying the water, undoing two couplings, removing the scaled interior, fitting clean one, and replacing couplings. In fact, Ufix is the only boiler in the United Kingdom in which the interior can be exchanged without disconnecting the boiler. This, combined with many other unique features makes the Ufix the most efficient and popular water heater obtainable today.

Write for price list and illustrated booklets.



THE UFIX BOILER CO. LTD.
144, King Street, Hammersmith, W.6.
Telephone : RIVerside 1245



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